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KATTEN MUCHIN ZAVIS ROSENMAN
575 MADISON AVENUE
NEW YORK, NY 10022-2585

EXAMINER	
ENG, MARSHALL S	
ART UNIT	**PAPER NUMBER**
2133	7

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Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	09/933,893	NIU ET AL.	
	Examiner	Art Unit	
	Marshall S Eng	2133	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *21 August 2001*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-17* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-17* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☒ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *21 August 2001* is/are: a)☐ accepted or b)☒ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☒ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. §§ 119 and 120

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

13)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application) since a specific reference was included in the first sentence of the specification or in an Application Data Sheet. 37 CFR 1.78.

a) ☐ The translation of the foreign language provisional application has been received.

14)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121 since a specific reference was included in the first sentence of the specification or in an Application Data Sheet. 37 CFR 1.78.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) *4*.
4) ☐ Interview Summary (PTO-413) Paper No(s). _____.
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: .

DETAILED ACTION

Priority

1.1 Receipt is acknowledged of papers filed under 35 U.S.C. 119 (a)-(d) based on an application filed in China on 27 October 2000 (Chinese Application No. 00130335.X). Applicant has not complied with the requirements of 37 CFR 1.63(c), since the oath, declaration or application data sheet does not acknowledge the filing of any foreign application. A new oath, declaration or application data sheet is required in the body of which the present application should be identified by application number and filing date.

1.2 A claim to priority under 35 U.S.C 119 (a)-(d) should also be made in the first line of the Specifications.

Drawings

2.1 The drawings are objected to because Figures 2 and 3 are not clear and fully readable. Higher quality copies of the drawings are suggested.

2.2 The drawings are objected to because Figures 8, 9, 10, and 11 are not clear and fully readable. Higher quality copies of the drawings are suggested.

2.3 A proposed drawing correction or corrected drawings are required in reply to the Office action to avoid abandonment of the application. The objection to the drawings will not be held in abeyance.

Specification

3.1 A substitute specification in proper idiomatic English and in compliance with 37 CFR 1.52(a) and (b) is required. The specification appears to be a literal translation into English from a foreign document and is replete with grammatical and idiomatic errors.

The substitute specification filed must be accompanied by a statement that it contains no new matter.

3.2 The specification is objected to as failing to provide proper antecedent basis for the claimed subject matter. See 37 CFR 1.75(d)(1) and MPEP § 608.01(o). Correction of the following is required: claim 10 states "the copy queues."

3.3 The specification is objected to as failing to provide proper antecedent basis for the claimed subject matter. See 37 CFR 1.75(d)(1) and MPEP § 608.01(o). Correction of the following is required: claim 11 states "the first copy queue."

Appropriate corrections are required.

Claim Objections

4.1 Claim 2 is objected to because of the following informalities: the language of the claim is not clear. For the purposes of examining, the limitations of the claim is being read as the following: the number of copies of packets to be retransmitted is based on the number of times the packet has been re-requested (NAK-ed) and the number of copies of packets sent increases with the number of times it has been re-requested (NAK-ed).

4.2 Claim 9 is objected to because of the following informalities: the language of the claim is not clear. For the purposes of examining, the limitations of the claim are being interpreted as they are presented in the specifications as, see lines 15-20 of page 12: the length of the interleaving transmission interval is the larger of the following two values 1) the minimum value of interval length and 2) the maximum number of different packets in the retransmission queue.

4.3 Claim 13 is objected to because of the following informalities: the language of the claim is not clear. For the purposes of examining, the limitations of the claim are being interpreted as they are presented in the specifications as, see lines 9-11 page 17: when transmitting the copy queues in order from queue 1 to queue N, even the queues that are empty are transmitted.

4.4 Claim 17 is objected to because of the following informalities: the meaning and use of the word special packet is unclear. It is further noted that the word specific is used. It appears that the first occurrence of "special" should apparently be "specific" and is being, for the purpose of examination, interpreted as such.

4.5 Claim 1 is objected to because of the following informalities: the claim should be indented to show that there is more than one limitation. The claim should be indented before the "wherein" on line 2.

4.6 Claim 17 is objected to because of the following informalities: the claim should be indented to show that there is more than one limitation. The claim should be indented before the "transmitting by" at the end of line 2.

4.7 Claim 16 is objected to because of the following informalities: the double colon following the word "steps" on line 2 should be a single colon.

Appropriate corrections are required.

Claim Rejections - 35 USC § 112

5.1 The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

5.2 Claims 1-17 rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

The claims are generally narrative and indefinite, failing to conform with current U.S. practice. They appear to be a literal translation into English from a foreign document and are replete with grammatical and idiomatic errors.

Claim Rejections - 35 USC § 103

6.1 The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

6.2 This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

6.3 Claim(s) 1-4 is/are rejected under 35 U.S.C. 103(a) as being unpatentable over Bao "Performance evaluation of TCP/RLP protocol stack over CDMA wireless link"

(hereinafter Bao) in view of Jeon et al. "Improved Selective Repeat ARQ Scheme for Mobile Multimedia Communications" (hereinafter Jeon).

As per claim 1,

Bao substantially teaches of retransmitting lost packets in a wireless communications (and hence fading) system including a transmitter and receiver (the mobile station and base station on page 230 act as both transmitters and receivers) where the transmitter after receiving a NAK from the receiver, retransmits the NAK-ed packet with multiple copies, see section 2.1 in column 2 of page 230.

Bao does not explicitly teach of transmitting multiple copies in response to a single NAK or of inserting a delay between two consecutive copies. Nonetheless, Bao does teach of teach of transmitting the multiple copies of the packet as the NAKs are received which causes an inherent delay between retransmissions of the same packet.

Jeon, in an analogous art, teaches of transmitting multiple copies of the NAK-ed packet on the receipt of a single NAK, where the NAK includes data as to inform the transmitter which trail the NAK came from, see section II on column 2 of page 46.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the retransmission technique of Bao to implement the multiple retransmission capabilities on the receipt of one NAK of Jeon. This modification would have been obvious because one of ordinary skill in the art would have been motivated because Bao is an explanation of EIA/TIA/IS-99 standard, see paragraphs 3 and 4 in column 2 of page 230 of Bao, (which was replaced by the EIA/TIA/IS-707 standard, see paragraph 2 in column 2 of page 46 of Jeon) and Jeon

teachings are a proposed improvement to the NAK based SR as taught in IS-707 see paragraph 2 in column 2 of page 46 of Jeon. Jeon further states that an early version of the SR of IS-707 was taught in IS-99 again see paragraph 2 in column 2 of page 46 of Jeon.

Further, adding a delay between retransmissions would have been obvious to one of ordinary skill in the art at the time the invention was made. One skilled in the art would know that communication systems (especially wireless ones) can suffer from poor channel conditions. If the retransmitted packets were transmitted back-to-back, one skilled in the art would recognize the fact that the packets would all be similarly affected by the poor channel conditions (i.e. noisy or causing a high error rate). Further, one skilled in the art would also know of burst errors that only affect data for a burst (or short period of time), leaving data outside of the burst is unaffected. Further, since the packet was already NAK-ed at least once, one skilled in the art has an indication that the channel is error prone. With the above in mind, one skilled in the art would clearly want to add some delay between multiple retransmissions to try to avoid all of the packets suffering from the same interference, or suffering a burst that covers parts of them, or the packets all suffering the same interference as the initial NAK-ed packet.

As per claim 2,

As noted in the above objection, the claim is unclear. Therefore, for the purposes of examining, the claim is being read as the following: the number of copies of packets to be retransmitted is based on the number of times the packet has been re-

requested (NAK-ed) and the number of copies of packets sent increases with the number of times it has been re-requested (NAK-ed).

When read in this light, it is clear that Jeon further teaches that the number of copies retransmitted is based on the NAK trail the NAK message belongs to. Further, the equation to calculate the number of packets is based upon the value of the NAK trail, hence making the number of copies increase as the more number of NAK trails are used, see section II in column 2 of page 46 of Jeon.

As per claim 3,

Bao further teaches of increasing the number of retransmissions in a linear fashion. Bao teaches of increasing the number of NAKs sent out from 1 to 2 to 3 up until a user defined limit. In response, the transmitter responds to each of the NAKs with a separate retransmission, see section 2.1 on column 2 of page 230.

When combined with the teachings of Jeon and his NAK trail, it is obvious to one of ordinary skill in the invention that the trail concept can be used for this linear increase as well as the exponential increase as taught by Jeon, see section II on column 2 of page 46 through the top column 1 of page 47.

As per claim 4,

Jeon further teaches of increasing the number of retransmission in an exponential fashion, see section II on column 2 of page 46 through the top column 1 of page 47.

6.4 Claim(s) 5-14 is/are rejected under 35 U.S.C. 103(a) as being unpatentable over Bao "Performance evaluation of TCP/RLP protocol stack over CDMA wireless link"

(hereinafter Bao) and Jeon et al. "Improved Selective Repeat ARQ Scheme for Mobile Multimedia Communications" (hereinafter Jeon). as applied to claim 1 above, and further in view of Kawabata et al. U.S. Pub No. 2002/0114292 (hereinafter Kawabata).

As per claim 5,

Both references, Bao and Jeon, substantially teach, as combined above, the method of retransmission. Bao substantially teaches of retransmitting lost packets in a wireless communications (and hence fading) system including a transmitter and receiver (the mobile station and base station on page 230 act as both transmitters and receivers) where the transmitter after receiving a NAK from the receiver, retransmits the NAK-ed packet with multiple copies in a FIFO manner, see section 2.1 in column 2 of page 230. Jeon, in an analogous art, teaches of transmitting multiple copies of the NAK-ed packet on the receipt of a single NAK, where the NAK includes data as to inform the transmitter which trail the NAK came from, see section II on column 2 of page 46.

None of the above cited references, Bao or Jeon, however, teach of using separate queues for transmitted data and retransmitted data, of transmitting the packets of retransmitting queue if it is not empty, or of transmitting data packets from the transmission queue when the retransmission queue is empty.

Kawabata, in an analogous art, teaches of ARQ systems using transmission and retransmission queues to hold data to be transmitted and data to be retransmitted, see page 2 paragraphs 27-31.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the method of Bao and Jeon, as combined above in claim

1, to include the separate queues for transmitted and retransmitted data as taught by Kawabata. This modification would have been obvious because one of ordinary skill in the art would have been motivated by the fact that Kawabata teaches the ARQ system of transmission and retransmission queues as prior art, see paragraphs 27-31 of page 2 and Figure 18. One of ordinary in the skill would obviously be able to take the known teachings of ARQ and apply them to the altered ARQ method, as combined above, of Bao and Jeon.

Further, it would have been obvious to one of ordinary skill to transmit copies of packets in the retransmission queue before continuing to transmit packets in the transmission queue. Clearly, if a retransmission request (NAK) is received and the packet is in the retransmission queue, it is of higher priority than a packet that hasn't been transmitted yet (and sitting in the transmission queue). Further, it would have been obvious to one of ordinary skill in the art that if the retransmission queue was empty, one should begin to transmit the packets sitting in the transmission queue.

Still further, sending packets out in an interleaving fashion is well known in the art as a method used to lessen the effect of errors on transmitted data. Therefore, it would have been obvious to one skilled in the art to further use packet interleaving on retransmitted data so as to attempt to further ensure that the retransmitted data is received correctly.

As per claim 6,

It would have been obvious to one of ordinary skill in the art at the time the invention was made to set up an interleaving retransmission interval (essentially

choosing the block length of the interleaving scheme). As is known in the art, interleavers are assigned a block length to know how many segments/packets are allowed per block. By using an interleaving scheme, one skilled in the art must set up the parameters (i.e. block length) of the interleaver.

Further, it would have been obvious to one of ordinary skill in the art to only include one copy of every packet in the retransmission queue per interleaver block. As is further known in the art, interleavers take data and interleave/re-map/reorder the positions of the data that do not come from the same codewords. With one skilled in the art already using an interleaving scheme, it would have been obvious to take the packets as the data and recognize that only one copy of a packet can be in a single block. The Examiner sees identical copies of packets as being related and draws the analogy of them coming from the same codeword in a traditional interleaver system. With them being from the same codeword idea, it is clear that only one copy of each packet to be retransmitted would be permitted per block length.

Still further, as noted above in claim 5, if the retransmission queue is empty, it would have been obvious to one of ordinary skill to then transmit the packets waiting in the transmission queue. With this in mind, it is clear that if the number of distinct packets of higher priority (i.e. ones that need to be retransmitted) is less than the size of the selected block length (interleaving retransmission interval), that one of ordinary skill would want to attempt to fill in the rest of the block length with packets from the transmission queue.

As per claim 7,

It would have been obvious to one of ordinary skill in the art at the time the invention was made that if there were no packets to retransmit (i.e. empty retransmission queue) and no packets to transmit (i.e. empty transmission queue) to stop the transmission and the forming of interleaved blocks. Clearly, if there was nothing left send, one skilled in the art would not want to try to form or transmit an empty interval/block.

As per claim 8,

It would have further been obvious to one of ordinary skill in the art at the time the invention was made that if the retransmission queue was not empty at the end of an interval/block to then start a new block with the remaining packets in the retransmission queue. Further if the retransmission queue were empty at the end of an interval/block, it would have been obvious to send the packets (if there are any) in the transmission queue. One of ordinary skill in the art would want to first attempt to retransmit packets in the retransmission queue because, similar to the ideas stated in claim 6, packets that have been NAK-ed clearly have a higher priority to send than those in the transmission queue. Therefore, it would have been obvious to one of ordinary skill to want to send the packets out of the retransmission queue before attempting to send any out of the transmission queue.

As per claim 9,

It would have been obvious to one of ordinary skill in the art at the time the invention was made to choose the interval length as the larger of the following two values 1) the minimum value of interval length and 2) the maximum number of different

packets in the retransmission queue. Obviously, one skilled in the art would make the interval size be at least equal to the minimum value of interval length. This value is a channel/system specific value and therefore must be met to conform to the protocols of the system. The other value, the maximum number of different packets in the retransmission queue, would, too, have been obvious to one of ordinary skill in the art. Clearly, if there were, for example, 5 different packets that had been NAK-ed (and therefore sitting in the retransmission queue) one of ordinary skill would want to be able to at least send one copy of each of the 5 different packets in one interval instead of being forced to send one "set" of the 5 retransmitted packets in multiple intervals.

Therefore, by choosing the larger of the two values, one of ordinary skill in the art would guarantee 1) the interval would meet the requirements set forth by the system/channel for block size and 2) the interval would be at least equal to the maximum number of different packets in the queue.

As per claim 10,

The limitations of claim 10 essentially claim distributing one copy of each of the packets in the retransmission queue to one of a plurality of copy queues, where each copy queue can only have one copy of a single packet. This is similar to the interleaving of the data packets into interval lengths that are described in claim 9. One can basically view the copy queues as sub queues within the retransmission queue after it has been interleaved. When read in this light, it is clear that it would have been obvious to one of ordinary skill in the art to separate the packets to be retransmitted into separate copy queues (sub queues). One of ordinary skill would be motivated to do this

because it is conceptually identical to interleaving the packets into interval lengths where only 1 copy of each packet can be in an interval. Each of the copy queues need only be seen as sub queues created out of the main retransmission queue. Further, it would have been obvious to take the packets as the data and recognize that only one copy of a packet can be in a single block/sub queue/copy queue. The Examiner sees identical copies of packets as being related and draws the analogy of them coming from the same codeword in a traditional interleaver system. With them being from the same codeword idea, it is clear that only one copy of each packet to be retransmitted would be permitted per block length/sub queue/copy queue.

As per claim 11,

It would have been obvious to one of ordinary skill in the art at the time the invention was made to retransmit the packets from the first copy queue until the last copy queue and then ending the interleaving interval when all queues are empty. One of ordinary skill in the art would be motivated to do this because, as stated above in claim 10, the idea of copy queues is conceptually identical to interleaving the packets into interval lengths where only 1 copy of each packet can be in an interval. Each of the interval lengths need only be seen as sub queues created out of the main retransmission queue. With this in mind, it is clear that the when transmitting the retransmission queue, one would start at the top of the queue and progress down in a FIFO manner. Therefore, with the interleaving intervals/ copy queues/sub queues filled (with only once copy of a packet per interval) it is clear that the first copy queue/sub queue/interval would be transmitted in a FIFO manner with the subsequent queues

being transmitted in a FIFO manner as well. Further, it would have been obvious to then transmit the packets from the transmission queue once all of the copy queues were empty. One of ordinary skill in the art would obviously want to transmit the packets in the transmission queue because they were all pre-empted in the transmission order by the packets that were NAK-ed and therefore retransmitted before them.

As per claim 12,

It would have been obvious to one of ordinary skill in the art at the time the invention was made to begin transmission of the next copy queue/sub queue/interval only after the previous copy queue/sub queue/interval was finished sending. One of ordinary skill would want to do this because due to the FIFO manner of transmitting the packets, the first copy queue/sub queue/interval would have to be empty before the next copy queue/sub queue/interval could begin. Clearly, in a FIFO scheme, with the main retransmission queue split into sub queues, the last packet of copy queue/sub queue/interval A would have to be transmitted before the first packet of copy queue/sub queue/interval A+1 could be sent out.

As per claim 13,

It would have been obvious to one of ordinary skill in the art at the time the invention was made to transmit all copy queues in order from queue 1 to queue N even if some of the queues were empty. One of ordinary skill in the art would want to transmit empty queues in sequence to ensure that there are not any queues further down the line that contain packets to retransmit (i.e. to ensure that an empty queue is not sitting between two queues that contain packets to be retransmitted). Further,

transmitting an empty queue is nothing more than skipping that queue and moving onto the next one in order. To one skilled in the art, "transmitting" an empty queue is nothing more than ensuring that that the queue tail is "popped" signifying the end of the current queue has been reached and therefore allowing the beginning of the next queue to be transmitted.

As per claim 14,

It would have been obvious to one of ordinary skill in the art at the time the invention was made to ensure that there were more copy queues/sub queues/intervals than the number of retransmission copies of a packet. As stated above in claim 6 and again in claim 10, it would have been obvious to take the packets as the data and recognize that only one copy of a packet can be in a single block/sub queue/copy queue. The Examiner sees identical copies of packets as being related and draws the analogy of them coming from the same codeword in a traditional interleaver system. With them being from the same codeword idea, it is clear that only one copy of each packet to be retransmitted would be permitted per block length/sub queue/copy queue. With this in mind, it is clear that one of ordinary skill in the art would want the number of copy queues/sub queues/intervals to be at least equal to the number of retransmission copies of a packet so as to have each queue only contain one copy of a packet.

6.5 Claim(s) 15 is/are rejected under 35 U.S.C. 103(a) as being unpatentable over Bao "Performance evaluation of TCP/RLP protocol stack over CDMA wireless link" (hereinafter Bao) and Jeon et al. "Improved Selective Repeat ARQ Scheme for Mobile

Multimedia Communications" (hereinafter Jeon). as applied to claim 1 above, and further in view of Kawabata et al. U.S. Pub No. 2002/0114292 (hereinafter Kawabata).

As per claim 15,

Both references, Bao and Jeon, substantially teach, as combined above in claim 1, the method of retransmission. Bao substantially teaches of retransmitting lost packets in a wireless communications (and hence fading) system including a transmitter and receiver (the mobile station and base station on page 230 act as both transmitters and receivers) where the transmitter after receiving a NAK from the receiver, retransmits the NAK-ed packet with multiple copies in a FIFO manner, see section 2.1 in column 2 of page 230. Jeon, in an analogous art, teaches of transmitting multiple copies of the NAK-ed packet on the receipt of a single NAK, where the NAK includes data as to inform the transmitter which trail the NAK came from, see section II on column 2 of page 46.

None of the above cited references, Bao or Jeon, however, teach of using separate queues for transmitted data and retransmitted data, of transmitting the packets in the transmission queue if the retransmission queue is empty, of setting and interleaving length, selecting one copy of every retransmission packet, of transmitting packets out of the transmission queue if the interval is not over and once copy of each retransmitted data has been transmitted, of stopping transmission until the end of the interval if both the transmission and retransmission queues are empty, or of transmitting the transmission queue packets when the retransmission queue is empty.

Kawabata, in an analogous art, teaches of ARQ systems using transmission and retransmission queues to hold data to be transmitted and data to be retransmitted, see page 2 paragraphs 27-31.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the method of Bao and Jeon, as combined above in claim 1, to include the separate queues for transmitted and retransmitted data as taught by Kawabata. This modification would have been obvious because one of ordinary skill in the art would have been motivated by the fact that Kawabata teaches the ARQ system of transmission and retransmission queues as prior art, see paragraphs 27-31 of page 2 and Figure 18. One of ordinary in the skill would obviously be able to take the known teachings of ARQ and apply them to the altered ARQ method, as combined above, of Bao and Jeon.

Further, it would have been obvious to one of ordinary skill to transmit copies of packets in the retransmission queue before continuing to transmit packets in the transmission queue. Clearly, if a retransmission request (NAK) is received and the packet is in the retransmission queue, it is of higher priority than a packet that hasn't been transmitted yet (and sitting in the transmission queue). Further, it would have been obvious to one of ordinary skill in the art that if the retransmission queue was empty, one should begin to transmit the packets sitting in the transmission queue.

Still further, sending packets out in an interleaving fashion is well known in the art as a method used to lessen the effect of errors on transmitted data. Therefore, it would have been obvious to one skilled in the art to further use packet interleaving on

retransmitted data so as to attempt to further ensure that the retransmitted data is received correctly.

Further, it would have been obvious to one of ordinary skill in the art at the time the invention was made to set up an interleaving retransmission interval (essentially choosing the block length of the interleaving scheme). As is known in the art, interleavers are assigned a block length to know how many segments/packets are allowed per block. By using an interleaving scheme, one skilled in the art must set up the parameters (i.e. block length) of the interleaver.

Further, it would have been obvious to one of ordinary skill in the art to only include one copy of every packet in the retransmission queue per interleaver block. As is further known in the art, interleavers take data and interleave/re-map/reorder the positions of the data that do not come from the same codewords. With one skilled in the art already using an interleaving scheme, it would have been obvious to take the packets as the data and recognize that only one copy of a packet can be in a single block. The Examiner sees identical copies of packets as being related and draws the analogy of them coming from the same codeword in a traditional interleaver system. With them being from the same codeword idea, it is clear that only one copy of each packet to be retransmitted would be permitted per block length.

Still further, as noted above in claim 5, if the retransmission queue is empty, it would have been obvious to one of ordinary skill to then transmit the packets waiting in the transmission queue. With this in mind, it is clear that if the number of distinct packets of higher priority (i.e. ones that need to be retransmitted) is less than the size of

the selected block length (interleaving retransmission interval), that one of ordinary skill would want to attempt to fill in the rest of the block length with packets from the transmission queue.

Further, it would have been obvious to one of ordinary skill in the art at the time the invention was made that if the were no packets to retransmit (i.e. empty retransmission queue) and no packets to transmit (i.e. empty transmission queue) to stop the transmission and the forming of interleaved blocks. Clearly, if there was nothing left send, one skilled in the art would not want to try to form or transmit an empty interval/block.

It would have further been obvious to one of ordinary skill in the art at the time the invention was made that if the retransmission queue was empty at the end of an interval/block to then start sending the packets (if there are any) in the transmission queue. One of ordinary skill in the art would want to first attempt to retransmit packets in the retransmission queue because, similar to the ideas stated in claim 6, packets that have been NAK-ed clearly have a higher priority to send than those in the transmission queue. Therefore, it would have been obvious to one of ordinary skill to want to send the packets out of the retransmission queue, if any, before attempting to send any out of the transmission queue, if any.

6.6 Claim(s) 16 is/are rejected under 35 U.S.C. 103(a) as being unpatentable over Bao "Performance evaluation of TCP/RLP protocol stack over CDMA wireless link" (hereinafter Bao) and Jeon et al. "Improved Selective Repeat ARQ Scheme for Mobile

Multimedia Communications" (hereinafter Jeon). as applied to claim 1 above, and further in view of Kawabata et al. U.S. Pub No. 2002/0114292 (hereinafter Kawabata).

As per claim 16,

Both references, Bao and Jeon, substantially teach, as combined above, the method of retransmission. Bao substantially teaches of retransmitting lost packets in a wireless communications (and hence fading) system including a transmitter and receiver (the mobile station and base station on page 230 act as both transmitters and receivers) where the transmitter after receiving a NAK from the receiver, retransmits the NAK-ed packet with multiple copies in a FIFO manner, see section 2.1 in column 2 of page 230. Jeon, in an analogous art, teaches of transmitting multiple copies of the NAK-ed packet on the receipt of a single NAK, where the NAK includes data as to inform the transmitter which trail the NAK came from, see section II on column 2 of page 46.

None of the above cited references, Bao or Jeon, however, teach of using separate queues for transmitted data and retransmitted data, of transmitting the packets of retransmitting queue if it is not empty, of transmitting data packets from the transmission queue when the retransmission queue is empty, or of setting copy queues to each include one copy of each retransmitted packet and transmitting the copy queues in sequence once the prior queue is completed sending and then ending retransmission and begin transmission of the packets in the transmission queue.

Kawabata, in an analogous art, teaches of ARQ systems using transmission and retransmission queues to hold data to be transmitted and data to be retransmitted, see page 2 paragraphs 27-31.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the method of Bao and Jeon, as combined above in claim 1, to include the separate queues for transmitted and retransmitted data as taught by Kawabata. This modification would have been obvious because one of ordinary skill in the art would have been motivated by the fact that Kawabata teaches the ARQ system of transmission and retransmission queues as prior art, see paragraphs 27-31 of page 2 and Figure 18. One of ordinary in the skill would obviously be able to take the known teachings of ARQ and apply them to the altered ARQ method, as combined above, of Bao and Jeon.

Further, it would have been obvious to one of ordinary skill to transmit copies of packets in the retransmission queue before continuing to transmit packets in the transmission queue. Clearly, if a retransmission request (NAK) is received and the packet is in the retransmission queue, it is of higher priority than a packet that hasn't been transmitted yet (and sitting in the transmission queue). Further, it would have been obvious to one of ordinary skill in the art that if the retransmission queue was empty, one should begin to transmit the packets sitting in the transmission queue. Still further, transmitting the packets with a multiple queue polling transmission is being interpreted as polling the copy queues/sub queues to determine if a certain queue is empty, and if it is to then move on to the next queue. It would have been obvious to one of ordinary skill in the art to poll queues to determine if they are empty. Essentially, polling a queue would consist of determining if the head of the queue is NULL or if the tail of the queue is at the head of the queue – with both, as is known in the art,

signifying that the current queue is empty. Once it has been determined that a queue is empty, then the next queue could be polled, and the process would continue on for the rest of queues.

The further limitations of the claim essentially claim distributing one copy of each of the packets in the retransmission queue to one of a plurality of copy queues, where each copy queue can only have one copy of a single packet. This is similar to the interleaving of the data packets into interval lengths that are described in claim 9. One can basically view the copy queues as sub queues within the retransmission queue after it has been interleaved. When read in this light, it is clear that it would have been obvious to one of ordinary skill in the art to separate the packets to be retransmitted into separate copy queues (sub queues). One of ordinary skill would be motivated to do this because it is conceptually identical to interleaving the packets into interval lengths where only 1 copy of each packet can be in an interval. Each of the interval lengths need only be seen as sub queues created out of the main retransmission queue. Further, it would have been obvious to take the packets as the data and recognize that only one copy of a packet can be in a single block/sub queue/copy queue. The Examiner sees identical copies of packets as being related and draws the analogy of them coming from the same codeword in a traditional interleaver system. With them being from the same codeword idea, it is clear that only one copy of each packet to be retransmitted would be permitted per block length/sub queue/copy queue.

Further, it would have been obvious to one of ordinary skill in the art at the time the invention was made to retransmit the packets from the first copy queue in sequence

until the last copy queue and then ending the retransmissions when all queues are empty. One of ordinary skill in the art would be motivated to do this because, as stated above in claim 10, the idea of copy queues is conceptually identical to interleaving the packets into interval lengths where only 1 copy of each packet can be in an interval. Each of the interval lengths need only be seen as sub queues created out of the main retransmission queue. With this in mind, it is clear that the when transmitting the retransmission queue, one would start at the top of the queue and progress down in a FIFO manner. Therefore, with the interleaving intervals/sub queues/copy queues filled, it is clear that the first copy queue/sub queue/interval would be transmitted in a FIFO manner with the subsequent queues being transmitted in a FIFO manner as well. Further, it would have been obvious to then transmit the packets from the transmission queue once all of the copy queues were empty. With all of the copy queues being empty, it would also signify the end of polling the queues to determine if they were empty/full. One of ordinary skill in the art would obviously want to transmit the packets in the transmission queue because they were all pre-empted in the transmission order by the packets that were NAK-ed and therefore retransmitted before them.

6.7 Claim(s) 17 is/are rejected under 35 U.S.C. 103(a) as being unpatentable over Bao "Performance evaluation of TCP/RLP protocol stack over CDMA wireless link" (hereinafter Bao) in view of Jeon et al. "Improved Selective Repeat ARQ Scheme for Mobile Multimedia Communications" (hereinafter Jeon).

Bao substantially teaches of retransmitting lost packets in a wireless communications (and hence fading) system including a transmitter and receiver (the

mobile station and base station on page 230 act as both transmitters and receivers, or transceivers) where the transmitter after receiving information that the receiver does not receive a specific packet (i.e. a NAK from the receiver), retransmits the non-received packet (NAK-ed packet) with multiple copies, see section 2.1 in column 2 of page 230.

Bao does not explicitly teach of retransmitting the specific packet in order at predetermined intervals (i.e. inserting a delay between two consecutive copies). Nonetheless, Bao does teach of teach of transmitting the multiple copies of the packet as the NAKs are received which causes an inherent delay between retransmissions of the same packet.

Jeon, in an analogous art, teaches of transmitting multiple copies of the NAK-ed packet on the receipt of a single NAK, see section II on column 2 of page 46.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the retransmission technique of Bao to implement the multiple retransmission capabilities on the receipt of one NAK of Jeon. This modification would have been obvious because one of ordinary skill in the art would have been motivated because Bao is an explanation of EIA/TIA/IS-99 standard, see paragraphs 3 and 4 in column 2 of page 230 of Bao, (which was replaced by the EIA/TIA/IS-707 standard, see paragraph 2 in column 2 of page 46 of Jeon) and Jeon teachings are a proposed improvement to the NAK based SR as taught in IS-707 see paragraph 2 in column 2 of page 46 of Jeon. Jeon further states that an early version of the SR of IS-707 was taught in IS-99, again see paragraph 2 in column 2 of page 46 of Jeon.

Further, adding a delay between retransmissions (retransmitting the specific packet at predetermined intervals) would have been obvious to one of ordinary skill in the art at the time the invention was made. One skilled in the art would know that communication systems (especially wireless ones) can suffer from poor channel conditions. If the retransmitted packets were transmitted back-to-back, one skilled in the art would recognize the fact that the packets would all be similarly affected by the poor channel conditions (i.e. noisy or causing a high error rate). Further, one skilled in the art would also know of burst errors that only affect data for a burst (or short period of time), leaving data outside of the burst is unaffected. Further, since the packet was already NAK-ed at least once, one skilled in the art has an indication that the channel is error prone. With the above in mind, one skilled in the art would clearly want to add some delay between multiple retransmissions to try to avoid all of the packets suffering from the same interference, or suffering a burst that covers parts of them, or the packets all suffering the same interference as the initial NAK-ed packet.

Conclusion

7.1 The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

a. Weldon "An Improved Selective-Repeat ARQ Strategy"

This reference teaches of repeating the transmission of NAK-ed blocks multiple times with the number of repeats increasing as more NAKs are received.

b. Jolfaei et al. "Improved Selective Repeat ARQ Schemes for Data Communication"

This reference teaches of retransmitting a block multiple times in accordance with how many times the block has been NAK-ed.

c. McMillen U.S. Patent No. 4,621,359

This reference teaches of multiple queue managing.

d. TIA/EIA/IS-707-A.2 "Data Service Options for Spread Spectrum Systems: Radio Link Protocol"

e. Tomcik et al. U.S. Patent No. 6,567,388

This reference teaches of retransmitting multiple copies of NAK-ed packets to increase the probability of successfully receiving a packet.

f. Fantacci "Queuing Analysis of the Selective Repeat Automatic Repeat Request Protocol Wireless Packet Networks"

This reference teaches of queue length and management when used in SR ARQ schemes.

g. Konheim "A Queueing Analysis of Two ARQ Protocols"

This reference teaches of queuing analysis of ARQ systems that employ NAKs.

7.2 Any inquiry concerning this communication or earlier communications from the examiner should be directed to Marshall S Eng whose telephone number is (703) 305-4638. The examiner can normally be reached on M-Th, 8:30 am to 5:30 pm and every other F, 9:00 am to 5:00 pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Albert DeCady can be reached on (703) 305-9595. The fax phone number for the organization where this application or proceeding is assigned is (703) 872-9306.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 305-3900.

mse

Guy J. Lamarre
for

Albert DeCady
Primary Examiner